

MANET Hidden and Exposed Terminal - Challenges and Survey

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Abstract - Mobile Adhoc Network (MANET) is a self organized wireless Network which was created to communicate among the nodes without support of the any Infrastructure. While transmission of the packets between the nodes, many challenges the every nodes faces. One of the Major challenges is Hidden and Exposed nodes issues in the MANET. This causes the packet drop or packet failure while the transmitting the packets. Also which reflects in degrades the throughput of the MANET and performance of the MANET nodes when the heavy traffic ,retransmission of the dropped packets delayed the communication. This article discussed about hidden and Exposed terminal problem and challenges in MANET and also dissimilar survey in MANET.

Keywords- MANET, Hidden and Exposed , Medium Access Control.

I. INTRODUCTION

The ideology of MANET was developed from difference Network evolutions. The Department of defence ((DoD) in the ear of 1970s innovated the Packet Network (PRNET) for utilizing in Military purpose. In 1980s the PRNET[1] chains for

Survivable Adaptive Radio networks (SURAN) program . A new Wireless Network with infrastructure which relays on aerial relay node with a 300 kilobits / sec throughput with supporting of 200 nodes was defined by the DARPA[2] [Defense Advanced Research Projects Agency].For accessing the medium the PRNET uses the ALOHA and CSMA

combination and distance vector for routing . SURAN uses highly scalable hierarchical link state routing protocol. While in 1990s New version of development in Adhoc Network based on RF development in a note book computer uses the infrared communication. Mobile host with collection of nodes in infrastructure less was proposed and IEEE 82.11 accepted the term as Adhoc Network .

Meanwhile The DoD two programs such as Global Mobile Information System (GloMo) for office environment Ethernet connectivity planned anytime, anywhere, in handheld devices using CSMA/CA and TDMA channel access with several routing algorithms and another program was the Near-term Digital Radio (NTDR) planned self organized two tier Adhoc network using link state routing and clustering routing that is used by US army which are done in the mid of 1990s for getting Adhoc standard.. The mobile ad hoc networking (MANET) group was invented by the IETF completed the routing protocol for Adhoc network. Collision avoidance and Hidden terminal Tolerated Medium Access Protocol was approved by IEEE 802.11 subcommittee.

For coordinating and transmitting of packets uses a MAC protocol from different nodes to minimize the collision. Various MAC protocols are there for different purposes CSMA/CA and MACA is for random access of carrier , TDMA , FDMA and CDMA are for channel partitioning. The MAC main function in 802.11are fragmentation, power save mode, Association , WEP, Scanning and Authentication etc. Hidden terminal problem means that more than two nodes are transfer the packets at the same time but the nodes are not in the same transmission range of the sender but it is on same transmission range of receiver.

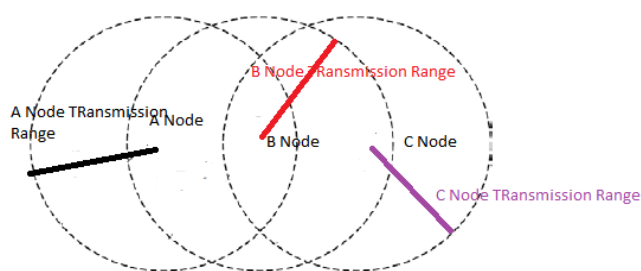


Figure 1.1 Hidden and Exposed Nodes

According to Figure 1.1, A and C nodes are Hidden nodes in each other if they try to send a packet to node B at the same time because B node is in the Range of A and C nodes. When B node sends a packet to A node, C detects that the signal is busy and is unable to transfer the packet to any other node, such as D, that is not in the same transmission range. In this situation, B is exposed to the c node.

II. LITERATURE SURVEY ON RELATED WORK

In this survey a brief study have been made for hidden and exposed terminal problem with various simulation results and all the literature to marking for the research work.

Caishi Huang et.[3]In this paper authors proposed the different receiver power, SINR , interference and transmission ranges .This paper shown high rate for sending the RTS/CTS packet for a given DATA broadcast. After that integration of transmission power control handles exposed terminal problem. Viral V. Kapadia, [4] authors introduces the better usage of RTS/CTS mechanism which create the jamming virtually with minimum power usage. Also uses the omni directional antenna which solves the obstacles in the protocol enhancement. .

Ms. RituPatidaret. al ,[5] : In this article the authors proposed the MAC protocol which is implemented with Sensor and directional antenna support for improving the performance of wireless sensor network .Lu Wang et. al in their paper [6]: The innovative Attachment Coding technique was suggested by the authors in this study as a means of attaching control information to data stream. This coding system allows for both data and control transmission while maintaining a respectable throughput for new data traffic..

Khaled H. Almotairi et. al in their paper[7] authors proposed the MMAC -HR for resolving the exposed terminal problem leads to poor channel utilization. Nodes does not required to use a channel l list for finding the free medium .the comparison results says that is better than the DCA in the aspect of throughput and delay Ketema Adere, Ramamurthy[8]:In this article, the authors suggested an omni directional and directional antennas based MAC protocol utilized in MAC to improve the performance of a wireless sensor network. Ki Hong Kim et al. In this research, the authors investigate MAC vulnerabilities and examine security weaknesses in the handshaking step, demonstrating that the design and implementation of a light weight low power authentication mechanism is appropriate for wireless networks. Albert Kai-Sun Wong, Caishi Huang, and Chin-Tau Lea[10].The authors of this work tackle the hidden and exposed terminal problem with the help of many proposed protocols such as contention based protocol, busy tone signal based protocol, power aware protocol, multiple channel based protocols, and so on.

Rutvij H. Jhaveri, Sudarshan N. Patel, and Viral V. Kapadia, [11]The authors of this publication conducted a comparative investigation of concealed and exposed terminals in an adhoc network using control systems such as RTS/CTS mechanisms, which resulted in an increase in transmission rate of 1.3 times in the Adhoc study. J. Chen, S. Sheu, and C. Yang [12] :The authors of this article examined the R-CA for dynamic channel interference, which was used for channel assignment. Channel assignment improves network throughput

and reduces interferences, resulting in greater MANET performance. Liu K, Wong T, Li J, et al)[13]: In IEEE 802.11, a simple DCF MAC approach allows for parallel transmission, eliminating the exposed terminal problem. The authors Liu Kai* and Xing Xiaoqin [14] proposed a novel MAC level protocol that provides the new method Back - off criterion employed by the Virtual Base Station.[15] (Lu Wang, Kaishun Wu, and Mounir Hamdi): The writers of this paper designed virtual jamming to prevent the many difficulties associated with RTS/CTS. Despite the fact that all of the writers proposed unique protocols and channels to address the limits in the Hidden and Exposed terminal problem, the Hidden and Exposed terminal problem could not be finalized in the MANET.

Despite the fact that all of the writers proposed unique protocols and channels to address the limits in the Hidden and Exposed terminal problem, the Hidden and Exposed terminal problem could not be finalized in the MANET. More study is required to complete the Hidden and exposed terminal problem with mutual exclusion among node communication.

III. PROPOSAL RESEARCH WORK TO OVERCOME THE HIDDEN AND EXPOSED TERMINAL PROBLEM

There are various ways presented to overcome the Hidden and Exposed terminal difficulty in the MANET Physical layer problems, but all of them have flaws and fall short. This survey article presented the Mutual exclusion Protocol for the MAC layer by maintaining hidden and exposed terminals in each node, which aids in locating hidden and exposed terminals in each region. Figure 3.1 depicts a sample MANET node formation, and Table 3.1 depicts its hidden and exposed Terminal nodes. As with the route finding prior to packet transmission, the hidden and exposed nodes fining is done in parallel, allowing the nodes to prevent collision.

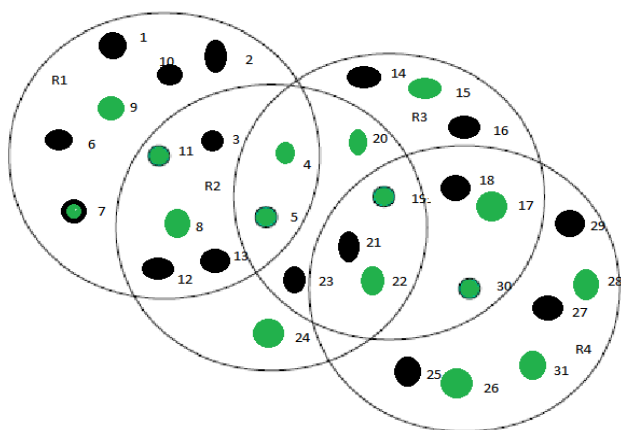


Figure 3.1 MANET Hidden and Exposed Nodes

Region	Hidden Terminal Example	Exposed Terminal Example
R1	6-20,	11-5-21
R2	3-14	3-4-14
R3	15-2	15-14-25
R4	27-16	22-30-27

Table 3.1 Hidden and Exposed Terminal table

IV. CONCLUSION

This article elaborate a survey on the Hidden and Exposed Terminal Problem and advocated mutual exclusion maintenance among nodes to aid in the resolution of the Hidden and Exposed Terminal Problem. This might be implemented using Network Simulator and including the new command and table maintenance in MANET nodes.

REFERENCES

- [1] R. Ramanathan and J. Redi,9 (2002) "A BriefOverview of ad hoc networks: challengesand Directions," IEEE Commun. Mag., vol.40, no. 5, May. 2002.
- [2] Dr. James A. ,Joseph P. MackerFreebersyser,Advanced Technology OfficeDefense Advanced Research ProjectsAgency, " Overview of CBMANET,ITMANET for WAND proposer Daymeeting" Feb27, 2007
- [3] CaishiHuang , Chin-Tau Lea , Albert Kai-Sun Wong (2012)," A joint solution for the hidden and exposed terminal problems in CSMA/CA wireless networks" in ELSEVIER,17 June, 2012.
- [4] Viral V. Kapadia, Sudarshan N. Patel and Rutvij H. Jhaveri, (2010)"COMPARATIVE STUDY OF HIDDEN NODEPROBLEM AND SOLUTION USING DIFFERENT TECHNIQUES AND PROTOCOLS" JOURNAL OF COMPUTING, VOLUME 2, ISSUE 3, MARCH 2010, ISSN 2151- 9617.
- [5] Ms. RituPatidar, Prof. Dinesh Chandra Jain,(2012) " Solving the Hidden Terminal problems Using Directional-Antenna Based MAC Protocol for Wireless Adhoc Networks" ijarcsse, Volume 2, Issue 5, May 2012.
- [6] CaiZ J Lu M, Wang X D. Channel access-based self-organized clustering in ad hoc networks. IEEETransactions on Mobile Computing 2003; 2(2): 102-113.
- [7] Sirse, D. ., & Gadgay, B. . (2023). An Augmented Reality framework for Distributed Graphical Simultaneous Localization and Mapping (SLAM). International Journal of Intelligent Systems and Applications in Engineering, 11(4s), 254 -. Retrieved from <https://ijisae.org/index.php/IJISAE/article/view/2651>
- [8] Khaled H. Almotairi and Xuemin (Sherman) Shen, "Multichannel medium access control for adhoc wireless

- networks” WIRELESS COMMUNICATIONS AND MOBILE COMPUTING(2011).
- [9] KetemaAdere, Rammurthy, “Solving the Hidden and Exposed Terminal problems Using Directional-Antenna Based MAC Protocol for Wireless Sensor Networks” 7th International Conference on Wireless and Optical Communication Networks, Colombo(2010).
- [10] S, D. A. (2021). CCT Analysis and Effectiveness in e-Business Environment. *International Journal of New Practices in Management and Engineering*, 10(01), 16–18. <https://doi.org/10.17762/ijnpme.v10i01.97>
- [11] Ki Hong Kim, Daejeon, Korea, “Security Attack based on Control Packet Vulnerability in Cooperative Wireless Networks” The Ninth International Conference on Networking and Services 2013.
- [12] Caishi Huang , Chin-Tau Lea , Albert Kai-Sun Wong,” A joint solution for the hidden and exposed terminal problems in CSMA/CA wireless networks” in ELSEVIER,17 June, 2012.
- [13] Viral V. Kapadia, Sudarshan N. Patel and Rutvij H. Jhaveri, “COMPARATIVE STUDY OF HIDDEN NODEPROBLEM AND SOLUTION USING DIFFERENT TECHNIQUES AND PROTOCOLS” JOURNAL OF COMPUTING, VOLUME 2, ISSUE 3, MARCH 2010, ISSN 2151- 9617.
- [14] Chen J, Sheu S, Yang C. A new multichannel access protocol for IEEE 802.11 ad hoc wireless LANs.Proc IEEE PIMRC 2003.2003; 2291-2296.
- [15] Thompson, A., Walker, A., Rodriguez, C., Silva, D., & Castro, J. Machine Learning Approaches for Sentiment Analysis in Social Media. *Kuwait Journal of Machine Learning*, 1(4). Retrieved from <http://kuwaitjournals.com/index.php/kjml/article/view/153>
- [16] Liu K, Wong T, Li J, et al. Performance analysis of UPMA protocol for wireless multihop mobile ad hoc networks. Proc IEEE WCNC 2003.2003; 971-976.
- [17] Liu Kai*, Xing Xiaoqin, “A New Exposed-terminal-free MAC Protocol for Multi-hop Wireless Networks” *Chinese Journal of Aeronautics* 22(2009) 285-292.
- [18] Lu Wang, KaishunWu,MounirHamdi, “Attached-RTS: Eliminating Exposed Terminal Problem in Wireless Networks” *IEEE TRANSACTIONS ON PARALLEL AND DISTRIBUTED SYSTEMS*,2012.

